May 17, 1932. D. B. MILLER 1,858,276

HAND TOOL

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Fig. 1.

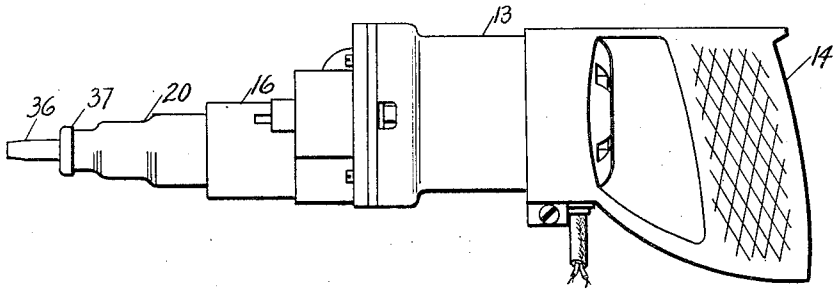


Fig. 2.

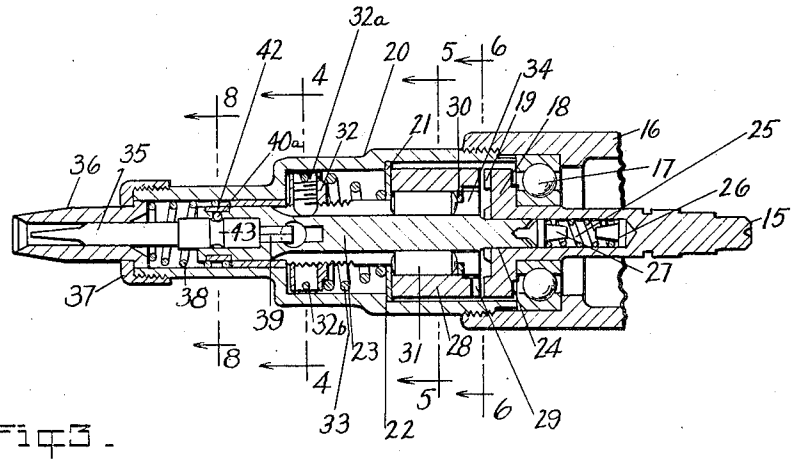
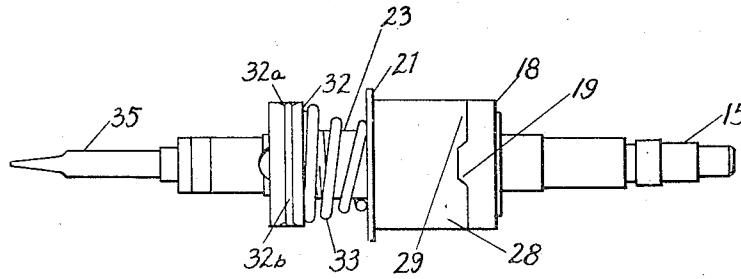


Fig. 3.



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Fig 4.

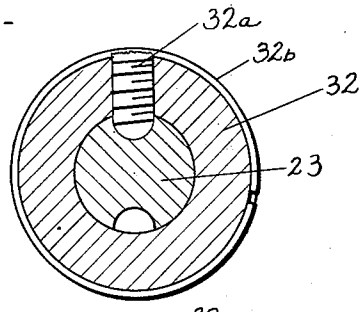


Fig 5.

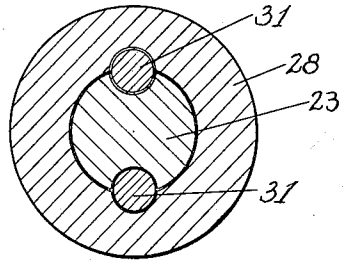


Fig 6

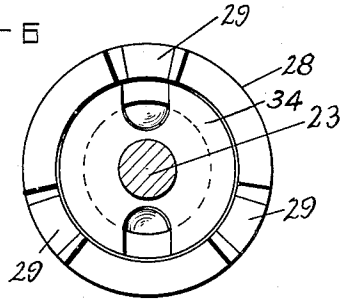


Fig 7.

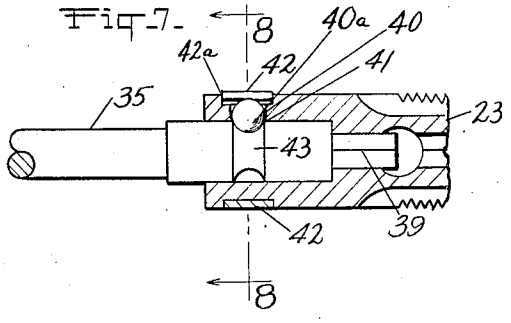


Fig 8.

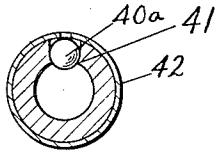


Fig 9.

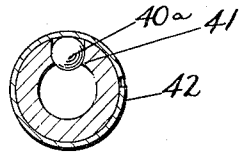


Fig 10.

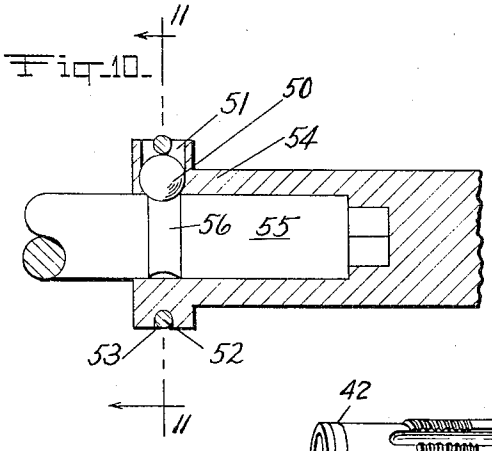
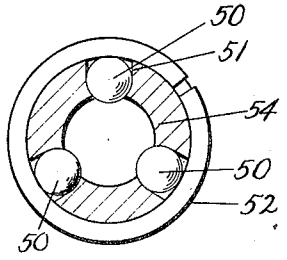


Fig 11.



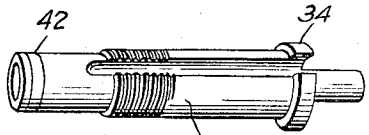


Fig 12.

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UNITED STATES PATENT OFFICE

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HAND TOOL

Application filed April 18, 1930. Serial No. 445,323.

This invention relates to hand tools and in certain of its aspects to rotary power driven hand tools.

An object of the invention is to provide a tool of the character described which is simple and sturdy in construction, which has long life, which may be readily and economically manufactured and assembled, and which will efficiently accomplish the purposes for which it is intended.

Another object is to provide an improved means for removably retaining a working member in place in a tool.

Another object is to provide an improved construction applicable particularly to power driven tools, whereby operation of the working member is automatically halted when resistance is offered to its operation.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the claim.

For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is an elevation of a power driven rotary screw driver embodying the invention;

Fig. 2 is a longitudinal section of the working end thereof;

Fig. 3 is a view of the clutch mechanism engaged;

Fig. 4 is an enlarged transverse section of the interior mechanism along the line 4—4 of Fig. 2;

Fig. 5 is a similar transverse section along the line 5—5 of Fig. 2;

Fig. 6 is a similar transverse section along the line 6—6 in Fig. 2;

Fig. 7 is an enlarged view of the forward portion of Fig. 2;

Fig. 8 is a sectional view along the line 8—8 of Fig. 2;

Fig. 9 is a similar view, showing parts in a different position;

Fig. 10 is a fragmentary longitudinal section of a modified form of holding means for a working member;

Fig. 11 is a transverse section along the line 11—11 of Fig. 10; and

Fig. 12 is a view in perspective of the spindle.

The invention is exemplified as embodied in a rotary screw driver adapted to be power driven, as for example, by a portable electric motor.

As will be seen, the tool comprises a casing 13 formed to provide a handle 14 and adapted to contain an electric motor or other driving means. Suitably connected with the motor is a shaft which is suitably mounted in a forward portion 16 of the casing by means of ball bearings 17. At its forward end, the shaft 15 carries a clutch member 18 formed with teeth 19 having bevelled edges. In the forward end of the casing member 16, there is removably secured a housing 20 which, as will be observed, is adapted to fully enclose the greater part of the working mechanism. Within this housing there is disposed an annular plate 21 which rests on shoulders 22 formed in the housing, and within this annular plate a working spindle 23 is mounted for longitudinal movement. The rear end of this spindle extends within a bore 24 formed in the forward end of the power shaft 15 and is resiliently pressed in a forward direction by means of a coil spring 25 bearing against a centering member 26 at the rear end of a recess and a similar member 27 at the rear end of the spindle. About the spindle 23 to the rear of the plate 21, is a clutch member 28 carrying at its rear end teeth 29, the edges of which are bevelled correspondingly to the edges of the teeth 19. It is to be observed that the inclination of these teeth permits the same to grip against one another to exert a driving action when the clutch is operating normally, but permits the teeth 19 to press the teeth 29 forwardly when the easy rotation of the clutch member 28 is prevented for any reason. The member 28 is mounted on the spindle 23 by any suitable

means which permits simultaneous rotation and relative longitudinal movement of these parts. As exemplified, this means comprises bearing members fitted in complementary grooves on the outside of the spindle and on the inside of the clutch member, such bearing members being suitably held in place as by an annular internal projection 30 on the clutch member. As bearing members, there are preferably employed roller bearings 31 which transmit motion with a minimum of strain on the parts, and which have a sufficiently large bearing surface to prevent excessive wear; it being understood, of course, that it is of particular importance to prevent wear in a tool of the power driven type, wherein slight play resulting from wear will render the operation of the tool particularly unsatisfactory. Carried on the spindle 23 at a point spaced forwardly of the annulus 21 is a second annulus 32 which is fixedly secured thereon by screw threads, supplemented by means of a screw 32*a* through the notch of which lies a split ring 32*b* which encircles the annulus 32. Between the plate 21 and the annulus 32 is a coil spring 33 tending to move the same apart. Movement of the plate 21 and the clutch member 28 rearwardly along the spindle is effectively prevented, however, by the annular shoulder 34 which is a part of spindle 23 cooperating with the clutch member. Suitably connected with the spindle 23 by means which will be hereinafter described, is a working member consisting in the present instance of a screw driver blade 35 over which is mounted a setting member 36 held in place by a cap 37 and yieldably held in a forward position by means of a spring 38.

In order to operate the exemplified tool, the setting member 36 is placed over the head of a screw and the tool pressed downwardly, so as to permit the setting member to recede against the spring 38 and the blade to fit into the head of the screw. This operation may be performed while the power shaft 15 is rotating, since the spring 25 tends to hold the spindle 23 and consequently the clutch member 28 in its forward position. Additional forward pressure on the tool results in a compression of the spring 25 and the engagement of the clutch members 18 and 28, with a consequent rotation of the spindle and the driving of the screw. If the screw encounters an obstruction, or when the screw has been completely driven into place, the resistance to the turning movement of the parts causes the teeth 19 and 29 to slip with respect to each other, so as to permit reciprocation of the clutch member 28 between the position shown in Fig. 3 and the position shown in Fig. 2, so as to cause an intermittent compression of the spring 33. The reciprocation of the clutch member 28 causes a knocking noise, upon the hearing of which the operator may withdraw the tool from position.

In such a construction it is desirable to reduce wear on the clutch teeth, and to this end the number of clutch teeth in the exemplified construction is reduced to a relatively small number, and the teeth 29 are formed with particularly long upper surfaces. Thus, during this slipping action, the teeth will make a minimum number of contacts with one another in each rotation.

In a tool of the type under consideration, it is often desirable to substitute one type of working member for another and to substitute one form of a given type of working member, such as a screw driver blade, for another form. Accordingly, it is of importance that the removal and insertion of such a blade may be accomplished with especial ease, and also that the removal of one working member and the insertion of another may be accomplished from a point outside the housing of the operating mechanism. To this end, there is provided in accordance with the invention a particularly effective and sturdy means for removably retaining a working member in place, said means being adapted for use in any of a wide variety of tools, wherein a working member is to be removably held in place, and being exemplified in connection with the particular tool shown.

It will be observed from Figs. 2 and 7, that the forward end of the spindle 23 is formed as a socket member and that there is provided in one side thereof a recess 40 adapted to receive a ball 40*a* and to permit a portion of this ball to project into the interior of the socket, the ball being prevented from falling entirely into the bore of the socket by a suitable means such as integral seat portions 41. In order normally to hold the ball in seated position there is provided a split ring 42 resting in an annular groove 42*a* in the socket member. The spring thus encircles the socket member and tends to press the ball inwardly. As will also be seen from Figs. 2 and 7 the blade 35 is formed with a recess, consisting in the present instance of an annular groove 43, adapted to receive the inwardly projecting portion of the ball 40*a*. There is thus provided a particularly satisfactory means for holding the blade 35 in place, this means serving, however, to permit the blade to be readily removed when the same is pulled outwardly, since it is only necessary to press the ball outwardly in its recess against the pressure of the split ring, whereupon the blade 35 can be removed and another screwdriver blade, a nut driving arrangement, a drill bit, or other suitable working member, substituted therefor. The interior of the rear portion of the socket and rear end of the working member may be suitably squared

as indicated at 39 or other suitable means may be provided to prevent relative rotation of the spindle and the blade.

If the split ring is arranged as indicated in Fig. 8 so as to embrace the ball between its ends the retaining device will operate particularly satisfactorily, since the spring-pressed ball will act effectively to prevent the blade from dropping out of the tool, whereas when it is desired to remove the blade the ends of the split ring will yield particularly readily to the withdrawing pressure. In many cases, however, it is sufficient to position the split ring haphazardly with respect to the ball, as indicated, for example, in Fig. 9. This of course is necessary in a construction in which a plurality of balls are used, such as indicated in Figs. 10 and 11, wherein there is exemplified a construction comprising three balls 50 fitting in a corresponding number of recesses 51. These balls are held in place by a split ring 52, which in the present instance is narrower than the balls, and is held in place in a narrow annular groove 53 in a socket member 54. The shank 55 of a suitable working member, which shank is formed in an annular groove 56, is exemplified as being held in place within the socket member 54.

While spherical members are the preferred form of retaining elements which are adapted to be pressed into recesses by a split ring, it is to be understood that the invention contemplates the use in certain instances of cylindrical or polygonal members, and it is to be understood that the term "ball," which is used herein for the sake of facility of expression, is intended to embrace all such members as might function similarly to the exemplified balls.

Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claim is intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent, is:

In a rotary power driven tool, in combination, a driven shaft having a clutch member at its forward end and being recessed at said end to provide a socket, a spindle extending into said socket, a spring within said socket, members at the rear end of said socket and at the rear end of said spindle adapted for centering said spring, housing means providing a mounting for said spindle and a shoulder, an annular clutch member slidably mounted on said spindle forwardly of the aforesaid clutch member, said annular clutch member and said spindle being formed with complementary grooves, means for slidably mounting said annular clutch member on said spindle, said mounting means comprising cylindrical bearing members fitting into said complementary grooves, and annular shoulder on said spindle adapted to limit the rearward movement of said annular clutch member relative to said spindle, a ring surrounding said spindle forwardly of said clutch member and adapted to seat against said first mentioned shoulder and to limit the forward movement of said annular clutch member and said spindle, an annulus carried on said spindle forwardly of said ring, said annulus being formed with a lateral bore and with an annular external groove and said spindle being formed with a recess, means to hold said annulus on said spindle, said holding means including a screw extending through the bore in said annulus and into the recess in said spindle, the head of said screw having a notch and a split ring fitting within said annular groove and extending through said notch, and a coil spring interposed between said annulus and said ring.

In testimony whereof I affix my signature.

DAVID B. MILLER.